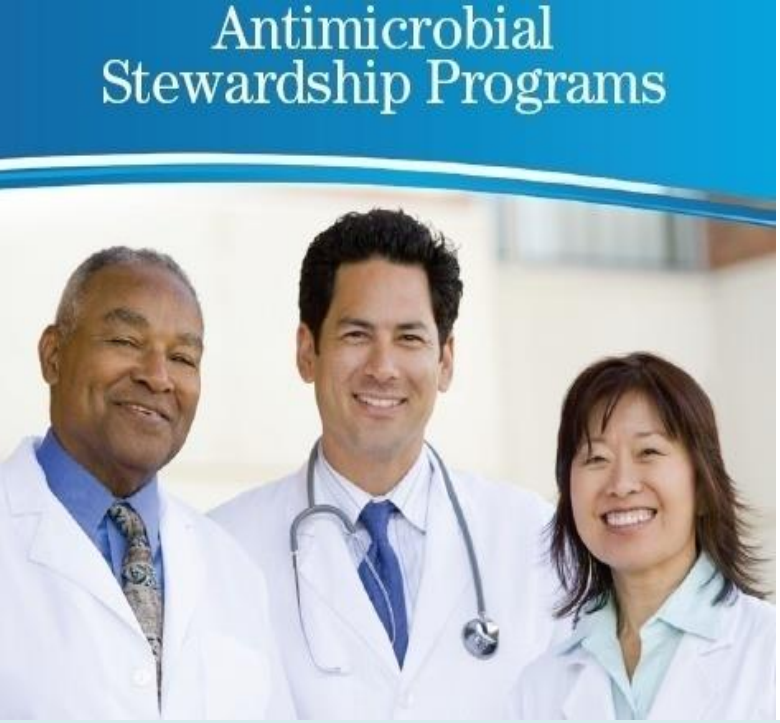


Antimicrobial Stewardship:

Arizona Partnerships Working to Improve the Use of Antimicrobials in the Hospital and Community

Part 7

"Antibacterials – indeed, anti-infectives as a whole – are unique in that misuse of these agents can have a negative effect on society at large. Misuse of antibacterials has led to the development of bacterial resistance, whereas misuse of a cardiovascular drug harms only the one patient, not causing a societal consequence."

- Glenn Tillotson; Clin Infect Dis. 2010;51:752

"…we hold closely the principles that antibiotics are a gift to us from prior generations and that we have a moral obligation to ensure that this global treasure is available for our children and future generations."

- David Gilbert, et al (and the Infectious Diseases Society of America). Clin Infect Dis. 2010;51:754-5

A Note To Our Readers and Slide Presenters

The objectives of the Subcommittee on Antimicrobial Stewardship Programs are directed at education, presentation, and identification of resources for clinicians to create toolkits of strategies that will assist clinicians with understanding, implementing, measuring, and maintaining antimicrobial stewardship programs.

The slide compendium was developed by the Subcommittee on Antimicrobial Stewardship Programs (ASP) of the Arizona Healthcare-Associated Infection (HAI) Advisory Committee in 2012-2013.

ASP is a multidisciplinary committee representing various healthcare disciplines working to define and provide guidance for establishing and maintaining an antimicrobial stewardship programs within acute care and long-term care institutions and in the community.

Their work was guided by the best available evidence at the time although the subject matter encompassed thousands of references. Accordingly, the Subcommittee selectively used examples from the published literature to provide guidance and evidenced-based criteria regarding antimicrobial stewardship. The slide compendium reflects consensus on criteria which the HAI Advisory Committee deems to represent prudent practice.

Disclaimers

All scientific and technical material included in the slide compendium applied rigorous scientific standards and peer review by the Subcommittee on Antimicrobial Stewardship Programs to ensure the accuracy and reliability of the data. The Subcommittee reviewed hundreds of published studies for the purposes of defining antimicrobial stewardship for Arizonan clinicians. The Arizona Department of Health Services (ADHS) and members of its subcommittees assume no responsibility for the opinions and interpretations of the data from published studies selected for inclusion in the slide compendium.

ADHS routinely seeks the input of highly qualified peer reviewers on the propriety, accuracy, completeness, and quality (including objectivity, utility, and integrity) of its materials. Although the specific application of peer review throughout the scientific process may vary, the overall goal is to obtain an objective evaluation of scientific information from its fellow scientists, consultants, and Committees.

Please credit ADHS for development of its slides and other tools. Please provide a link to the ADHS website when these material are used.

Introduction to Slide Section

- **Preface:**

  Manual antimicrobial utilization calculations and adjustment by census and patient location is laborious and frequently inaccurate. Several vendors provide software to assist in targeting potential interventions, documentation, and presentation or creation of reports. However, some EMR systems already provide ASP metrics. Time not spent in creating daily reports, identifying interventions, or collecting patient-related data provides more time for education, project development, and acting on interventions.

- **Content:**

  10 slides for self-study and assessment of technology resources currently or potentially available. How to assess the need to purchase new software specifically designed for ASPs is also discussed.

- **Suggestions for Presentation:**

  “What are the means to collect data and identifying antimicrobial prescribing interventions?” This is an important question because time needed for data collection is inversely proportional to the number of daily interventions. CDSS needs to be discussed early in the ASP development.

- **Comments:**

  CDSS becomes part of the business planning and daily activities.

ANTIMICROBIAL STEWARDSHIP: COMPUTERIZED AND CLINICAL DECISION SUPPORT SERVICES (CDSS)

Computer Decision Support Systems (CDSS): Programmable Dashboards

- Programming current computer systems may assist in targeting antibiotic prescribing activities, but are difficult to develop as “home-made” software

Twelve Potential Identifiers to Consider for “Real-Time” Stewardship	
Core measure compliance (CAP)	Pathogen-drug mismatch
Creatinine clearance and targeted antibiotics	Patients on ≥ 3 antibiotics
Identify antibiotics as IV-to-PO candidates	Recent positive cultures
Restricted antibiotic lists	Antibiotic therapy ≥ 7 days
Vancomycin ≥ 3 days with negative cultures	Vancomycin therapy for unlikely pathogen
Duplicative therapy	Disease-drug mismatch (linezolid-UTI)

- Several third-party software vendors are geared toward stewardship and may be run in parallel with EMRs, such as Epic and Cerner[1]
- Several commercial third=party vendors focused toward antimicrobial stewardship are available but at an appreciable cost (range, $100,000 to $500,000 per year – depending on institution size)[1]

1 Kullar R et al. Clin Infect Dis. 2013;57:1005-13

Computer-Assisted Strategies

- Software programs interface with several databases
  - Electronic medical record (EMR) or health record (EHR)
  - Electronic medication administration record (eMAR)
  - Laboratory and radiology reporting systems
- Software programs augment the stewardship program in many ways
  - Identify high-use antimicrobial agents
  - Track disease demographics within an institution (e.g., % patients admitted for pneumonia)
  - Identify target patients that prioritize stewardship review or may be at risk for emergence of MDROs (e.g., patient scoring to identify “high-risk” patients)
  - Consolidate patient-specific information (e.g., patients on vancomycin whose renal functions are rapidly changing
  - Documentation and assessment of outcomes of specific antibiotic regimens
  - Incorporate treatment guidelines, order sets, and “best practice alerts (BPAs)”
  - Communicate and record ASP recommendations and interventions
  - Allergy information and maximum dose checking
  - 96-hour stop dates[1]

1 Kullar R et al. Clin Infect Dis. 2013;57:1005-13

Computerized Decision Support Services (CDSS): A Solution to Our Problems?

Problems with traditional interventions:

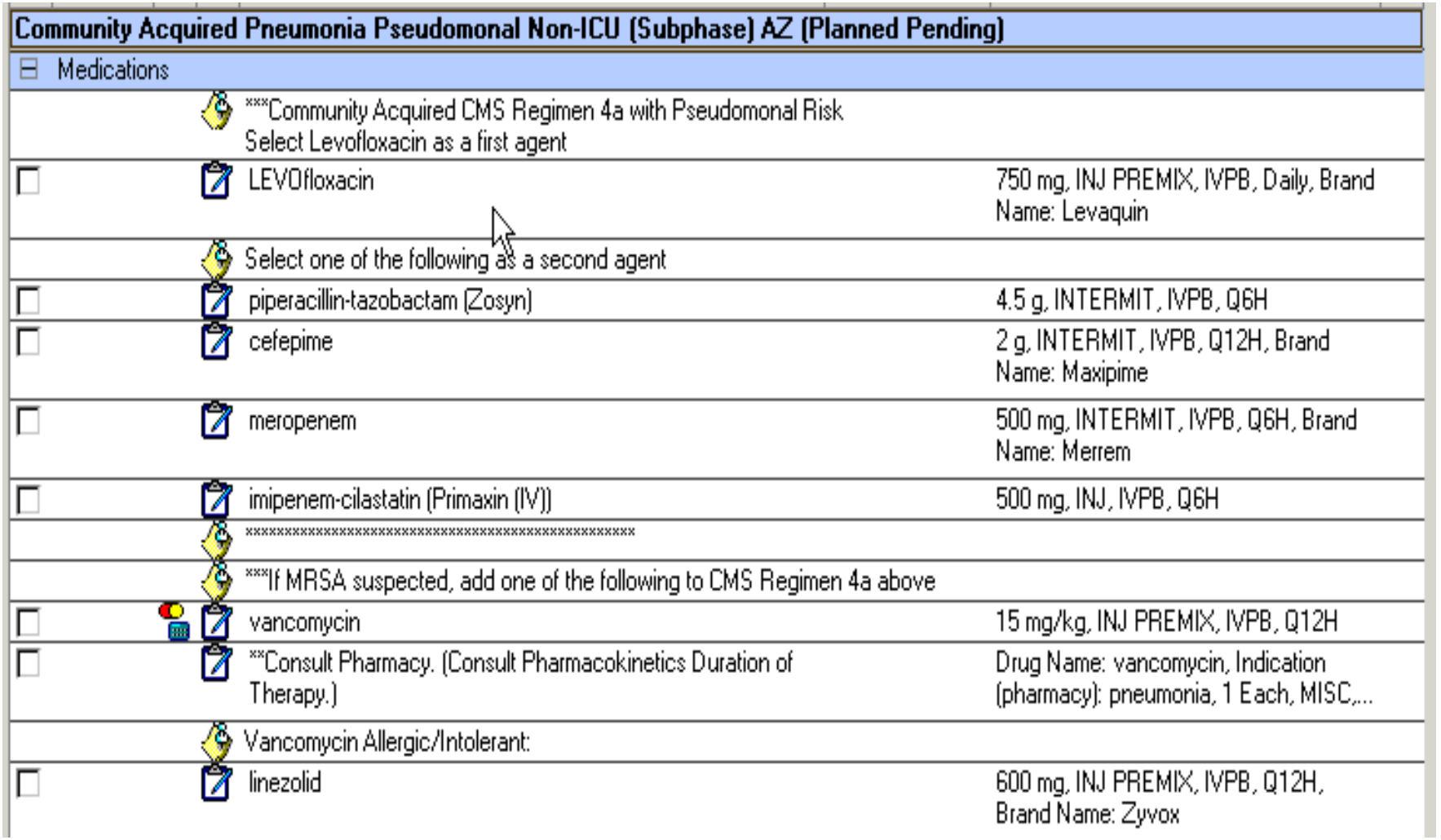
- Antimicrobial decision-making is complex
  - Drug-drug, drug-food interactions
  - Allergies and contraindications
- Multiple variables to consider
  - Clinical suspicion of infection and empiric therapy
  - Common pathogen(s)
  - Antibiogram data
- Incomplete patient-specific information
  - Individual patient characteristics
  - Prior cultures
  - Organ system issues
- Timeliness, integration, and synchronicity between point of care and decision support
- Population and institutional considerations
- Guidelines and regulations

Features of CDSS likely to increase clinician uptake:

- Primary determinant of user satisfaction is speed
- Integrate CDSS with clinical workflow
- Easy to use; avoids arduous data entry
- Simple and evidence-based recommendations
- Documentation of reasons to override recommendations
- Impacts are monitored; provide performance feedback
- Provides incentives to use CDSS
- Aligns guideline developers and users
- Adaptable to local users and data
- Accompany CDSS with conventional education

Thursky K. Expert Rev Anti Infect Ther. 2006;4(3):491-507.

Example: Community-Acquired Pneumonia, Risk for Infection with *Pseudomonas,* Non-ICU



Community Acquired Pneumonia Pseudomonal Non-ICU (Subphase) AZ (Planned Pending)		
Medications		
	***Community Acquired CMS Regimen 4a with Pseudomonal Risk Select Levofloxacin as a first agent	
☐	LEVOfloxacin	750 mg, INJ PREMIX, IVPB, Daily, Brand Name: Levaquin
	Select one of the following as a second agent	
☐	piperacillin-tazobactam (Zosyn)	4.5 g, INTERMIT, IVPB, Q6H
☐	cefepime	2 g, INTERMIT, IVPB, Q12H, Brand Name: Maxipime
☐	meropenem	500 mg, INTERMIT, IVPB, Q6H, Brand Name: Merrem
☐	imipenem-cilastatin (Primaxin (IV))	500 mg, INJ, IVPB, Q6H
	**********	
	***If MRSA suspected, add one of the following to CMS Regimen 4a above	
☐	vancomycin	15 mg/kg, INJ PREMIX, IVPB, Q12H
☐	**Consult Pharmacy. (Consult Pharmacokinetics Duration of Therapy.)	Drug Name: vancomycin, Indication (pharmacy): pneumonia, 1 Each, MISC,...
	Vancomycin Allergic/Intolerant:	
☐	linezolid	600 mg, INJ PREMIX, IVPB, Q12H, Brand Name: Zyvox

Courtesy: Dr Teresa Seville, MD; Mayo Clinic Hospital, Phoenix AZ, October 2013

Example: Implementation of a Clinical Decision Support System and Use of Computerized Alerts

- Quasi-experimental pre-/post-intervention study
  - Absence of reliable identification of patients with potential ASP interventions; no prospective audit or intervention/feedback (pre-implementation, Sept 2007-Feb 2008)
  - Introduction of a computerized system in Oct 2008 (TheraDoc, Hospira Inc) led to a system of prospective audit with intervention and feedback
  - Post-implementation study period Sept 2009-Feb 2010
- 8 types of alerts generated by electronic surveillance: influenza and pneumococcal vaccination, polyantibacterials, redundant anaerobic agents, drug-bug mismatch, vancomycin for coagulase-negative staphylococci, vancomycin for MSSA, and lack of positive cultures
- Post-implementation actionable alerts = 2,054 (24% of all alerts generated electronically); non-vaccination actionable alerts = 707
- Results: 88% (250/284) of interventions were accepted
- Alert type with highest number of actionable alerts was ‘no positive cultures’ (374 of 1,096 alerts, 34%)
- Significant time spent reviewing alerts, making interventions on actionable alerts, and documentation (2-5 hours/day)

Hermsen E et al. Infect Control Hosp Epidemiol. 2012;33(4):412-5.

Example: Computer-Assisted Surveillance for Redundant Antibiotic Combinations

- Pharmacist-based intervention at a 600-bed public teaching hospital
- Study included 1,189 inpatients receiving at least 2 antibiotics during a 23-day surveillance (1 month)
  - 137 episodes (11.5%) of inappropriate combinations
  - 98% compliance in changing regimens
- Cost savings $10,800, decreased 584 days of therapy of redundant drug
  - $83 cost-savings per episode
  - Total pharmacist time $2,880 (0.33 hr per case)
- Annualized cost-savings $48,000 (includes labor of ID pharmacist)

Glowacki RC et al. Clin Infect Dis 2003;37:59-64

Example: The Impact of a Computerized Physician Order Entry Program Targeting Linezolid Use

- Prospective evaluation of linezolid use in a 214-bed nonacademic community hospital–based hospital following addition of an ID physician to the program
- Subsequent addition of a customized CPOE-ASP order entry template with linezolid decision algorithm based on FDA-approved indications
  - Alternative therapies were provided
- Monitor linezolid use during a 32-month period (Jan 2008 to Sept 2010)
- Results:
  - Baseline linezolid use (7 months) averaged 44 DDD/1,000 PTD
  - Decrease to mean of 7 DDD/1,000 PTD and sustained over 16-months following CPOE implementation and ID physician involvement ($P<0.001$ from baseline)
  - The proportion of non-appropriate linezolid use decreased from 77% (26 of 34 orders) to 11% (1 of 13 orders; $P<0.003$)
  - No changes in LOS, census, patient case mix
  - No effect on LOS for skin and soft tissue infections nor incidence of VRE
  - Overall cost of linezolid over 16 months after CPOE-ASP implementation resulted in a cost savings of more than $638,000, compared to 16 months prior to CPOE-ASP implementation (annualized, cost savings approximately $479,000 yearly)

Po L, et al. Infect Control Hosp Epidemiol. 2012;33(4):434-5

The Role of Electronic Medical Records and Technology: Summary

- Begin planning early; institution-specific IT programming may take several months
- Identify early institution-specific templates from vendor menus, so the ASP Team must decide on a desirable set of prompts which address the current antimicrobial prescribing deficiencies and objectives of the ASP program
- Work with other departments to resolve issues of competition and prioritization of programming requests and project builds
- Network with other ASP practitioners to gain their experience with EMR and third-party software vendors; be familiar with shortcomings, timelines, interface and compatibility issues, and future product updates
- Evaluate the vendor's technical support capabilities and response time
- Work with contracting departments to identify upfront costs, annual fees, and costs of updates
- None of the currently available programs can measure the impact of ASPs, so your documentation will need to be translated into deliverables
- Systems should have reporting options consistent with NHSN's AUR module